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WITNESS my hand this
Twenty-first day of January 2004

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AUSTRALIA
Patents Act 1990

PROVISIONAL SPECIFICATION

Invention Title: CONTAINER STOPPER

Applicant: PROCORK PTY LTD

The invention is described in the following statement:

CONTAINER STOPPER

Technical Field

The present invention relates to an improved container stopper for stoppering an opening in a container, and a packaged product incorporating such an improved stopper.

A number of products are packaged in containers where the opening in the container is sealed using a stopper. In these circumstances, the stopper typically forms an interference fit within the container opening. One of the most common examples of a packaged product that uses such a stopper is wine, although other beverages and edible oils are also common examples. The improved container stopper of the present invention has particular application as a cork-type stopper typically associated with bottles of wine and oil, although it will be appreciated that the invention is not limited to this particular type of container stopper, but may have application in other fields.

Background

Wine is traditionally packaged in bottles that are sealed with cork stoppers. Stoppers made form cork have historically been used in the wine industry for a variety of reasons, most of which relate to the natural qualities of the cork that make it suitable for this purpose. By way of example, cork as a material is durable, resilient, free from rotting, is permeable to gas, is predominantly waterproof, is readily compressible and is easy to shape into a variety of desired conformations.

A disadvantage of using cork stoppers, however, is that they can lead to the development of undesirable scent and flavour characteristics in the packaged product. In particular, cork is known to be a cause of musty or mouldy taint in wine, and sometimes a cause of 'off' flavours due to oxidation. Indeed, it is estimated that approximately five percent of wines are affected in this way. In 1994 the Quercus project was initiated by the European cork industry to reduce the occurrence of poor or 'off' flavours. TCA (2,4,6 Trichloroanisole) has been identified as the cause of some musty/mouldy taint. Although cork is not the only source of TCA in wine, it has been shown that some corks contain levels of TCA that are transferred to wine when stored in

bottles. It has also been observed that the taints can be transferred to the wine via vapour when the bottles are left standing up and the liquid does not contact the cork surface. This is due to cork's poor barrier to volatile materials, demonstrated by its readiness to absorb and desorb moisture vapour with changes in relative humidity, its susceptibility to the entry of the volatiles which may be retained and later transferred to wine.

Another consideration is whether the product needs to be completely sealed off from the environment or whether gaseous exchange is desirable to improve the characteristics of the product. With bottle storage of wine, for example, flavour development of the wine with aging has to be taken into account. Although the concept of bottle aging, bottle maturation or bottle development is well known, it is in fact little understood or scientifically proven. There is some belief that the stopper breathes and that oxygen plays a role in bottle development of the wine, although it is well proven that too much oxygen will oxidise a wine and ruin it. There is a growing body of work that is developing the use of micro-oxygenation to develop flavour and mature wines. Any stopper for use in the wine industry therefore should be permeable to some extent to allow some oxygen to permeate the stopper and come into contact with the wine.

A number of approaches have been developed aimed at overcoming the problems of contamination of the product by the stopper whilst at the same time retaining the oxygen permeability characteristic. For example, it has been shown that coatings can be used to improve the performance of cork stoppers. Waxes and paraffins may be used as coating and applied to corks to improve the sealing capability. If this is done, paraffins are usually used in solid, oil or emulsion form. It has also been observed that wax coatings can reduce the amount of liquid that soaks into the cork over time. Silicone coatings have also been applied to corks to improve the insertion and extraction of the cork. It is thought that the silicone reduces the friction between the cork and the bottle during both the insertion and extraction processes. Coatings of this type are typically applied to the corks while the corks are tumbling in a rotating drum. The corks may be tumbled with a solid wax block or a liquid is squirted or otherwise sprayed onto corks. The coating is then spread from cork to cork by

the physical contact between the corks transferring the coating and evenly distributing it. Heat may also be applied to aid the process.

There have been attempts to place other types of physical barriers between the stopper and the wine to prevent the transmission of tainting components to the wine. Several of these attempts have worked on the principle of applying a coating layer in the form of a polymeric film to the end of the stopper. However, the characteristics of the stoppers produced using prior techniques have not always been satisfactory. Without wishing to be bound by theory it is thought that the problem with these approaches is that whilst the stopper is compressible (as required for insertion into the neck of the bottle) the coating layer is typically not compressible. This leads to the development of imperfections in the coating layer such as cracking, peeling, creasing and the like.

Patent application WO 00/34140 purports to overcome these problems and describes a composite stopper with a body and a thick moulded elastomer plug at the end of the stopper in contact with the wine. The elastomer plug acts to seal the bottle and is claimed to be a taint barrier. While this approach may overcome the problems of taint, it does have its drawbacks. For example, the unit cost of each stopper is significantly higher than the unit cost of cork stoppers in general, and so is undesirable from an economic standpoint. In addition, elastomer plugs of the type described have a high inherent transmission rate for oxygen and tainting molecules such as TCA, thereby requiring the plug to be thick to achieve the required oxygen and taint barrier properties for desirable bottle aging and taint reduction. Further, as the exact orientation of the stopper into the opening of the container is crucial for proper performance of this particular stopper, expensive capping machinery is typically required to ensure adequate performance of the stopper once fitted.

The present inventor made a study of prior art stoppers and found that many of the deficiencies observed with prior art coating techniques were apparently caused by the radial compression of the stopper during its insertion into a container opening. It was found that if the compression of the film could be reduced, then problems associated with the use of such coating films could

be ameliorated. One method of achieving this is described in co-pending application PCT/AU02/00877, which employs tapering at the end of the stopper.

The present invention provides alternative solutions to those disclosed in the co-pending application. In particular, the applicant has found that by shaping the end of the stopper and applying the film certain ways, and/or by providing a foam material on the end of the stopper, improved performance of the stopper can be obtained.

Thus, the present invention aims to provide a new and improved stopper configuration, and a packaged product incorporating such a stopper.

Summary

The present invention contemplates stoppers formed in a variety of shapes and configurations. The stoppers are usually elongate and may have any of a variety of cross-sectional shapes, with the cross-sectional shape typically determined by the shape of the opening the stopper is intended to seal. Most usually, however, the stopper will have a generally cylindrically shaped body. Accordingly, the end of the stopper adapted for insertion into the container opening will usually have a generally circular cross-sectional configuration and may present a generally planar end surface. The end surface of the stopper may not be entirely planar, however. For example, a peripheral edge region at the end of the stopper may be tapered or chamfered, and/or the end may have a stepped configuration forming a shoulder region. The end could also conceivably have a curved or rounded surface.

According to one aspect, the present invention provides a container stopper comprising a body of compressible material having at least one end for insertion into an opening of a container, and a film coating on at least part of said end of the body of compressible material for providing a protective barrier between the compressible material and the contents of the container, wherein the end of the stopper body includes a step or shoulder region at a periphery thereof and a substantially centrally located protrusion.

In a preferred form of the invention, the shoulder region of the stopper extends radially inwardly from an outermost periphery of the stopper end. The radial extent of the shoulder region is preferably substantially perpendicular to a

longitudinal axis of the stopper. Thus, in the event that the stopper body is generally cylindrical, the step or shoulder region is a generally annular and encircles the central protrusion.

In a preferred form of the invention, the central protrusion has a generally cylindrical or frusto-conical form. Accordingly, the central protrusion preferably has a substantially planar endmost surface, and either cylindrical or conical side surfaces. Furthermore, this protrusion may optionally be partly recessed into the shoulder region such that a recess or groove in the shoulder region surrounds the base of the protrusion.

In a preferred form of the invention, the film coating is provided on the outer surface of the centrally located protrusion. Preferably, the film coating substantially entirely covers the endmost surface of the centrally located protrusion only. Alternatively, the film coating may substantially entirely cover the outer surface of the centrally located protrusion, including the side surfaces thereof. The film coating may optionally also cover at least a portion of the step or shoulder region.

In a preferred form of the invention, the container stopper includes a region of foamed material provided at the end of the stopper body. The foamed material is preferably provided at the step or shoulder region, although it may also be provided on the centrally located protrusion. The foamed material is preferably a non-tainting and non-scalping material such as a foamed plastic.

In a preferred form of the invention, the area of the step or shoulder region is more than 10% of the total surface area of the end of the stopper body, and more preferably more than 20% of the total surface area of the end of the stopper body (which includes the shoulder region).

In a preferred form of the invention, the film is a polymeric film and preferably has multiple layers including at least one barrier layer and at least one adhesive layer. Any suitable barrier layer may be used. However, examples of preferred barrier layers include at least one polymer selected from the group consisting of: polyethylene, polypropylene, polyethylene terephthalate, polyvinyl chloride, polydivinyl chloride, polyvinyl dichloride, polyvinyl acetate, ethylene-vinyl acetate, ethylene-vinyl alcohol and polyvinyl

alcohol, polycarbonates, polystyrene, polyalkylene oxide polymers, and any possible copolymers of any of the foregoing.

The compressible material of the stopper is preferably selected from the group consisting of: natural cork, agglomerated cork and micro-agglomerated cork. Of course, a polymeric material such as a medium density or low density closed-cell foamed plastic (as disclosed in US patent 6,355,320) could also be used, as could a number of fibrous materials (as disclosed in US patent 5,665,462).

One of the advantages of the present invention is that when the stopper sits compressed within the neck of a bottle, most of the compressive deformation is confined to the outer peripheral region of the stopper body. This leaves the film coating on the outer surface of the end of the stopper substantially unaffected by wrinkling, which in turn means that the protective barrier provided by the film suffers substantially reduced adverse affects.

According to another aspect, the present invention provides a container stopper comprising a body of compressible material having at least one end for insertion into an opening of a container, and a film coating on at least part of said end of the body of compressible material for providing a protective barrier between the compressible material and the contents of the container, wherein the end of the stopper body includes region of foamed material. This region of foamed material is also able to reduce the adverse effects of wrinkling.

Preferably, the foamed material comprises a polymer selected from the group of polymers mentioned herein as being suitable or preferred for the barrier layer of the film coating on the end of the stopper body. The foamed material is preferably a closed-cell type foamed polymer.

In a preferred form of the invention, the end of the stopper body tapers towards an endmost surface of the stopper and the foamed material is provided in the region of taper. Preferably, a peripheral edge region at the end of the stopper is tapered or chamfered and the foamed material is located at the peripheral edge region. Indications are that for technical performance, the foam is only required at the peripheral edge region. For practical ease in production of the stopper, however, it is sometimes preferable for the foam to cover the entire end of the stopper.

In a preferred form of the invention, the end of the stopper body includes a step or shoulder region at a peripheral edge region thereof and the foamed material is provided in the shoulder region. The end of the stopper body also preferably includes a substantially centrally located protrusion.

The shoulder region of the stopper extends radially inwardly from the outer periphery of the stopper end, with the radial extent of the shoulder region preferably being substantially perpendicular to a longitudinal axis of the stopper. Thus, in the event that the stopper body is generally cylindrical, the step or shoulder region is a generally annular and encircles the central protrusion. As already described, the central protrusion preferably has a generally cylindrical or frusto-conical form. Accordingly, the central protrusion preferably has a substantially planar endmost surface, and either cylindrical or conical side surfaces. Furthermore, this protrusion may optionally be partly recessed into the shoulder region such that a recess or groove in the shoulder region surrounds the base of the protrusion.

According to a further aspect, the present invention provides a packaged product comprising a liquid in a container, such as a bottle. The container includes a container stopper according to the invention as described with respect to either aspect above, with the container stopper received in an opening of the container (typically formed in a neck of the bottle) in an interference fit to thereby seal the container opening.

The stoppers of the invention can be used for the storage of a wide range of materials. it is preferred that the material is a fluid, particularly beverages including wine, edible oils, and even chemicals such as acids.

Description of the Drawings

For assistance in arriving at a better understanding of the present invention, examples of a container stopper according to preferred forms of the invention are hereafter described with reference to the accompanying drawings. The preceding description may also be read with reference to those drawings. However, it should be understood that the drawings are not intended to limit the generality of the preceding description.

In the drawings, like reference numerals designate like features and:

Fig. 1 shows a schematic side view of an end of a container stopper according to a preferred form of the invention;

Fig. 2 shows a schematic side view of an end of a container stopper according to another preferred form of the invention;

Fig. 3 shows a schematic side view of an end of a container stopper according to a further preferred form of the invention;

Fig. 4 shows a schematic side view of an end of a container stopper according to yet another preferred form of the invention;

Fig. 5 shows a schematic side view of an end of a container stopper according to a further preferred form of the invention;

Fig. 6 shows a schematic side view of an end of a container stopper according to still another preferred form of the invention;

Fig. 7 shows a schematic side view of an end of a container stopper according to yet a further preferred form of the invention; and

Fig. 8 shows a schematic side view of an end of a container stopper according to another preferred form of the invention.

Detailed Description

In the wine industry, bottling operations typically utilise high speed stoppering machines which subject the cork-type stoppers to large compression forces. These machines typically have a number of compression jaws, which radially compress the stopper from its normal diameter to about half of its original size. The machines then employ a ram to force the compressed stoppers directly into the bottle openings where the stoppers expand creating a tight interference fit in the neck of the bottles, and thus seal the bottle.

Naturally, therefore, the stoppers of the present invention should have a compressible body. It is preferred that the stopper body be formed of a material that can be compressed by at least 5 percent, more preferably by at least 10 percent, even more preferably by at least 20 percent, and preferably by at least 30 percent. A number of materials having these properties may be used. Most preferably, however, the stoppers produced with the present invention have bodies formed from natural cork, agglomerated cork, micro-agglomerated cork, or a combination thereof.

The stoppers are usually elongate and may have any of a variety of cross-sectional shapes, with the shape of the stopper essentially being determined by the shape of the opening it is intended to seal. As mentioned previously, however, the stoppers will most typically have a generally cylindrical body, with the standard dimensions being 24mm diameter and 45mm length.

The stoppers also have a film applied to the end stopper inserted into the bottle neck opening. The film is preferably a polymeric film, and it typically has multiple layers, including an outer barrier layer and an inner adhesive layer.

The barrier layer preferably has a low permeability to hydrogen, oxygen and carbon dioxide, and is substantially impermeable to organic molecules with molecular weights greater than 40. A number of barrier layers are known in the art that can be utilised to achieve this result. Preferably, the barrier layer includes one or more polymers selected from the group consisting of polyethylene and copolymers thereof, polypropylene and copolymers thereof, polyethylene Terepthalate and copolymers thereof, ethylene-vinyl acetate and polyvinyl acetate and copolymers thereof, polyvinylchloride and copolymers thereof, polydivinylchloride and copolymers thereof, polyvinyldichloride and copolymers thereof, polyvinylacetate and copolymers thereof, ethylene vinyl alcohol and polyvinyl alcohol and copolymers thereof, ethylene acrylic acetate, ethylene acetic alcohol, polyurethane and copolymers thereof, polyacrylonitrile and copolymers thereof, cellophane, polyamines, polycarbonates, polystyrene and copolymers thereof, polyalkylene oxides and copolymers thereof, polyethylene oxides and copolymers thereof, cellulose, cellulose derivatives, and metal, aluminium oxide, silica and silicon polymers. A preferred barrier film has a multi-layer structure and includes PVDC, PDVC, EVOH, EAA or metal.

The barrier layer preferably has a thickness in the range of 1 to 50 micron, more preferably in the range of 2 to 20 micron, and most preferably in the range of 5 to 15 micron.

The adhesive layer may be laminated to the barrier layer, or it may be added to the film or cork by way of a spray or extrusion. Suitable adhesive layers include heat activated adhesive compounds (eg in a laminated layer) and hot-melt adhesive compounds (eg applied to the film as a spray). Suitable adhesive compounds therefore include ethylene vinyl acetate, polyamides,

acrylics, methyl methacrylate based polymers, starch based adhesive, carbohydrate based adhesives, protein based adhesives, animal glues, rubber, silicone, epoxy, melamine-formaldehyde based, unsaturated polyesters, urea-formaldehyde resins, resorcinol, phenolic, anaerobic adhesives, urethanes, polysulfides, polyvinyl and ethylene vinyl acetates. Particularly preferred adhesives are ethylene vinyl acetate homopolymer or co-polymer.

The adhesive layer preferably has a thickness in the range of 0.1 to 10 micron, and more preferably in the range of 1 to 5 micron. If a heat activated adhesive is used, it preferably has an activation temperature greater than about 40°C, more preferably greater than about 60°C, and most preferably greater than about 80°C.

Referring to all of Figs. 1 to 8 of the drawings, various examples of an end (1) of a cork-type stopper are shown in side view. The corks have a generally cylindrical body having a diameter (ϕ) equal to about 24 mm. The overall length of the cork body is typically about 45 mm. The end (1) of the stoppers shown in the drawings are adapted for insertion into the neck opening of a wine bottle, and include a coating of polymeric film (F) to provide a protective barrier between the cork material and the contents of the bottle.

Referring now to Fig. 1 of the drawings, an end (1) of a particular cork-type stopper is shown in side view. This end (1) of the cork body includes a step or shoulder region (2) at its periphery, which forms a centrally located protrusion (3). The step or shoulder region (2) of the stopper extends radially inwardly from an outermost periphery of the cylindrical body substantially perpendicularly to a longitudinal axis of the cork. The width (x) of the shoulder region (2) is typically in the range of about 0.5 mm to about 3 mm, and more preferably in the range of about 1 mm to about 2 mm. Accordingly, the shoulder region (2) is typically in the form of an annular flat surrounding the substantially centrally located protrusion (3). These dimensions for the shoulder region (2) are also generally applicable to the examples shown in Figs. 2 to 6.

As is clear from Figs. 1 and 2 of the drawings, the protrusion (3) has the general form of a squat cylinder, with a substantially planar endmost surface (4) and cylindrical side surfaces (5). The height (h) of the protrusion beyond the annular flat of the shoulder region (2) is typically in the range from about 1 mm

to about 5 mm, and preferably in the range from about 2 mm to about 4 mm. These dimensions for the protrusion (3) are also generally applicable to the examples shown in Figs. 3 to 6. The film coating (F) covers substantially the entire outer surface of the protrusion, including the endmost surface (4) and the side surfaces (5). An annular region of foamed material (6) is also provided around the peripheral shoulder region (2).

Fig. 2 of the drawings shows a side view of the end (1) of a cork-type stopper having a configuration substantially the same as that shown in Fig. 1. The main difference is that the region of foamed material (6) extends as a layer over substantially the entire outer surfaces (4,5) of the protrusion, as well as over the shoulder region (2).

Figs. 3 and 4 of the drawings illustrate further examples of cork-type stoppers according to the present invention. In each of these cases, the protrusion (3) has a substantially frusto-conical form extending from the flat annular step or shoulder region (2) at the peripheral edge of the stopper body. Accordingly, the endmost surface (4) of the protrusion is still substantially planar, but the side surfaces (5) of the protrusion now have a conical taper. The film coating (F) is again applied to substantially cover the entire outer surface, i.e. both the endmost and side surfaces (4,5) of the protrusion. In Fig. 4, the annular shoulder region (2) also again includes a layer of foamed material (6) similar to the example shown in Fig. 2.

Referring now to Figs. 5 and 6 of the drawings, side views of the insertion end (1) of two further cork-type stoppers are illustrated. In these examples, the protrusion (3) is again of frusto-conical form, as in Figs. 3 and 4. In these examples, however, the protrusion (3) is partly recessed into the step or shoulder region (2) such that a circular recess or groove (7) surrounding the base of the protrusion (3) is formed in the shoulder region. This recess or groove (7) is substantially circular and typically has a depth in the range from about 0.25 mm to about 1.5 mm, and more preferably in the range from about 0.5 mm to 1 mm. The polymeric film (F) applied to the end of the cork body again covers substantially the entire outer surface of the protrusion including both the substantially planar endmost surface (4) and the conical side surfaces (5). The example in Fig. 6 of the drawings is similar to that in Fig. 5, but

includes a region of foamed material (6) provided in the step or shoulder region (2) at the base of the protrusion (3). The foamed material (6) does not cover the entire shoulder region but may optionally fill the recess or groove (7).

Finally, Figs. 7 and 8 illustrate examples in which the end (1) of the cork body has a peripheral edge region, which is chamfered or tapers to a substantially planar endmost surface (4). The endmost surfaces and the tapered/chamfered peripheral edge region are both coated with the polymeric film (F). In Fig 7, the endmost and chamfered surfaces are also covered with a layer of the foamed material (6). In Fig. 8, just the tapered region includes the layer of foamed material (6).

The taper provided at the end of the cork body in the various example of the present invention naturally results in the area of the endmost surface being less than the maximum cross-sectional area of the cylindrical stopper body. It is found that only minor reductions in area at the end of the body are required to achieve the desired outcome. The taper may be such that the area at the endmost surface is less than 98 percent of the maximum cross-sectional area of the body, preferably less than 95 percent, more preferably less than 85 percent, and most preferably between 75 percent and 85 percent of the cross-sectional area of the body. Without wishing to be bound by theory, it is thought that such reduction allows for the control of the compression of the film during compression of the stopper body for insertion into the container.

It has been found that any of a number of different tapers can be used to achieve this desired result. For example, the taper may be a uniform or a non-uniform taper. It is preferred, however, that the taper is a uniform taper as this is the form that is most easily mass-produced, and therefore the most desirable from an economic standpoint. At least in principle, however, any type of taper, even stepwise tapers, may be used. Thus, the taper may be straight or curved in shape. It is preferred, however, that the taper not be so extreme that the area of the stopper body on which the film is located becomes smaller than the opening of the bottle it is intended to seal. If this occurs, there is a compromise of the effectiveness of the seal.

One preferred method of forming the taper of the stopper body is to produce a stopper and then chamfer the end to achieve a tapered stopper body.

This chamfer step can occur either before or after the attachment of a film. In addition to machining a stopper body (either before or after application of a film) to achieve the taper discussed above, the taper can also be achieved by attaching a tapered layer or disc to the end of a preformed stopper to produce a composite stopper body with a tapered region at one end. Whilst this technique can be utilised, it is not preferred as it is not cost-effective as these stoppers then become expensive to produce relative to the machining technique.

With stoppers formed according to the present invention, it is typical that the stopper body will have two ends, and each of the two ends will have the same configuration. The advantage of this is that stoppers can then be used in conventional corking machines, and no discrimination between the two ends of the stoppers is required. Therefore, using stoppers with two ends each having the same shape allows the stoppers to perform their desired function irrespective of the capping technique used.

Finally, it will be appreciated that various alterations and/or additions may be introduced into the particular construction and arrangement of parts specifically described with reference to the drawings without departing from the spirit or ambit of the present invention.

DATED : 7 January, 2003

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David P Fitzpatrick

Fig. 1

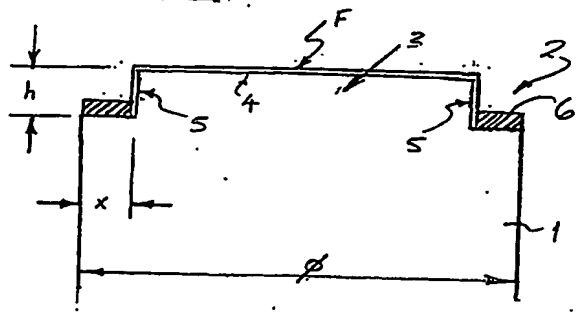
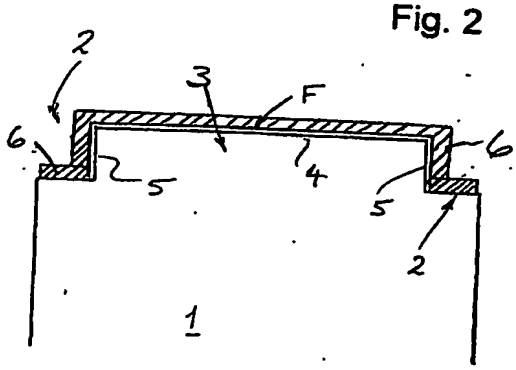


Fig. 2



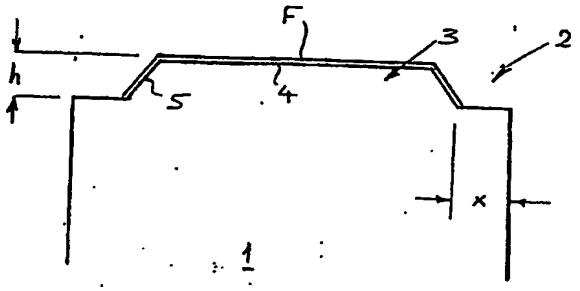


Fig. 3

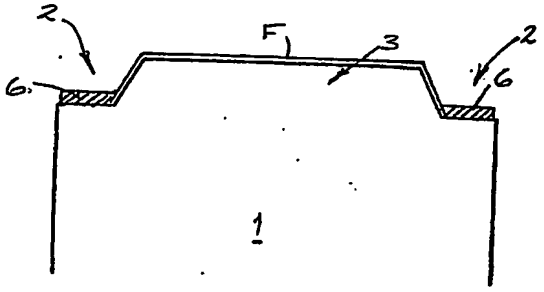


Fig. 4

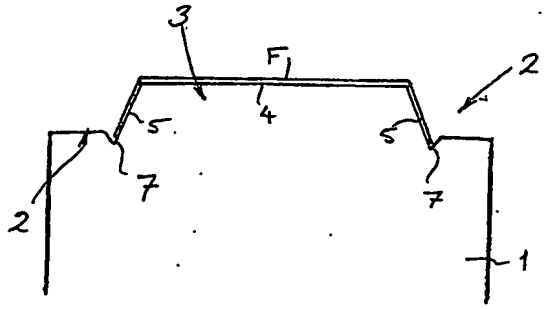


Fig. 5

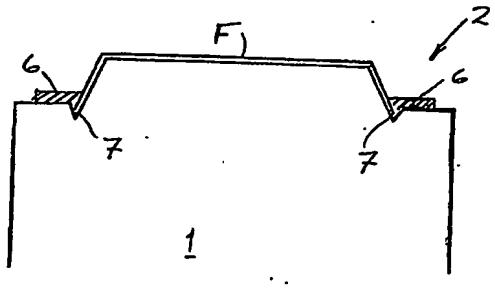


Fig. 6

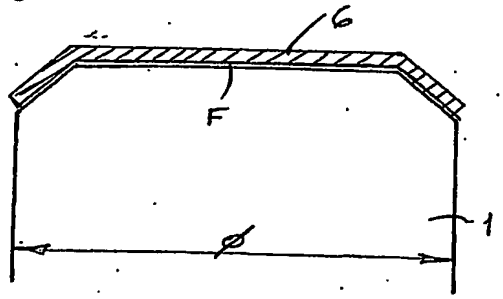


Fig. 7

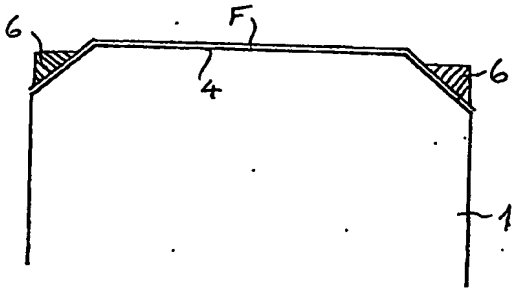


Fig. 8